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ELECTRIC POWER COSTS AND THE FUNCTIONS  
OF ELECTRICITY UNDERTAKINGS

Report submitted by the  
Energy Division of the United Nations Economic Commission for Europe

NOTE: This text is subject to editorial revision.



1. Trends in the cost of electric energy

The operating expenses of an electricity undertaking may be classified into three categories:

- The first comprises financial charges, depreciation of fixed assets and wages. It is proportional to the size of the equipment, which is composed of the plants, the networks and the transformer stations.
- The second comprises charges for fuel and lubricants, and also those incurred in maintenance, inspection and repairs. It is proportional to the amount of electric power supplied to the consumer.
- The third, of less significance than the two previous categories, is composed of general expenses, insurance and taxes; it depends on the turnover of the undertaking.

In the case of an electricity undertaking which depends exclusively on hydro plants, the first category is relatively the most important in view of the large sum which has to be invested in the construction of the means of production.

In the case of an electricity undertaking having only thermal plants, the second category is as important as the first, by reason of the high expenditure on fuel.

Lastly, an intermediate state of affairs obtains in the case of undertakings operating a network that is fed by thermal and hydro plants.

Accordingly, the trend of the cost of electric energy is a reflection of the following four parameters:

- the utilization factor of the installed capacity;
- the cost per kW of installed capacity;
- financial charges which, in their turn, depend on the undertaking's capital;
- the specific consumption of the thermal stations per kWh produced.

In general, the development of electrification tends to raise the utilization factor of the installed capacity, with the consequence that the cost of the electric power produced is lowered. Moreover, progress in the construction of plants results in a reduction of the specific costs per kW and of the fuel consumption in thermal plants, notably through higher steam temperatures and pressures. In addition, the increase in the specific consumption of electric power per consumer and the utilization of production units of ever increasing capacity, as well as of

higher voltages, have the effect of reducing the share accounted for by wages.

However, this downward trend is offset partly by the price of fuels in thermal plants and by the fact that, as the best sites are already developed in the case of hydro-electric power, the cost of building these plants tends to rise. That is why in the final analysis the cost of electric energy has remained virtually stable since the Second World War.

## 2. Rate-fixing of electric power

Rate-fixing is particularly difficult in the case of electric power, inasmuch as this form of energy cannot be stored and its supply depends on the consumer. The cost depends therefore on the utilization factor of the maximum load taken by the consumer from the network and on the hour at which this operation takes place.

In the case of such household uses as lighting, the utilization factor of the maximum load and the hour at which this load occurs do not differ appreciably from one consumer to another, and simple rates based only on the energy consumed can be applied.

By contrast, other household uses such as heating and cooking and also industrial uses require more complex rates which are based not only on the energy consumed but also on the hour at which the supply took place and, possibly, on the maximum capacity taken from the network. After the war, particularly in France, an attempt was made to apply the theory of "sale at the marginal price" to the fixing of electricity rates. In theory, this results in a fair apportionment of the operating expenses among the different categories of consumer and gives them an incentive to adjust their demand to production conditions [3]

Furthermore, for the purpose of allowing for fluctuations in the cost which are due to fluctuations in the price of fuels used in thermal plants, contracts for the supply of electricity to large consumers generally contain clauses linking the two items. Some countries, such as France and Belgium have, in addition, adopted a system tying the selling price of electric power to an economic index determined from month to month.

## 3. Trends in the selling price of electric power

The supply of electric power is in the first place a public service which is in all countries governed by administrative regulation; in some countries, these regulations empower the authorities to supervise the electricity tariffs [2] for the purpose of protecting the consumer against excessively frequent changes and,

likewise, of intervening effectively in this sector in conformity with a national economic policy.

The efforts of the undertakings to supply electric power at moderate prices during slack periods, and so to influence the utilization factor of the installed capacity, have gradually modified the relative position of this form of energy for the purpose of its use in certain thermal and chemical industries. However, the substitution of electricity for other forms of energy often requires an investment by the consumer. This investment might be jeopardized if a subsequent change in the rates were to occur. The special rates granted in certain cases by the electricity producing undertakings are accordingly based on the assumption that these undertakings maintain those rates for a certain period.

Hence, the relative stability of the selling prices is explained, firstly, by the commitments entered into by the electricity undertaking vis-à-vis the consumers and, secondly, by government supervision.

4. The financial management of electricity undertakings and the problems involved in the financing of new projects

The financial management of an electricity undertaking is characterized by the relatively high proportion of fixed assets and current assets (stocks, advances on orders, customers' accounts and sums owed by other debtors).

In general, the fixed assets are almost entirely covered by permanent capital such as issued capital, reserves and long-term debts. Liquidity does not therefore present any particular problems since short-term debts are, to a large extent, covered by securities likewise realizable at short notice.

Although receipts suffice amply to cover current operating expenses, it can happen that the annual surplus of receipts is not enough for the purpose of replacing equipment or even of amortizing certain long-term loans. In those cases the reason is that, as has been seen above, there is sometimes a certain imbalance between the true cost - which depends on the cost of living - and the selling price, the increase of which meets resistance both from the customers and from the authorities.

The problem of the financing of new electric power projects is accordingly a particularly delicate one. It is the subject of a special study undertaken by the Committee on Electric Power of the Economic Commission for Europe (see Annex II to this document).

This study analyses first the structure and financial position of the electricity undertakings in certain countries of Europe. Then it discusses the problem of the financing of new projects and the various ways in which the problem has been solved. Lastly, it itemizes the consequences of a change in rates and gives some indication of the economic and social effects of an increase in rates.

In addition, it will be noted that the Organization for European Economic Co-operation (OEEC) has published two studies which also deal with this problem, though from a different angle. [1] and [4].

Furthermore, the studies published by the International Union of Producers and Distributors of Electrical Energy (UNIPED) include one, which was submitted to the Lausanne Congress, concerning amortization and cost calculations. [5]

Lastly, the International Bank for Reconstruction and Development submitted a report on the subject to the World Power Conference held at Madrid in 1960. [6]

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A N N E X I

- [1] The price of electricity  
- its relation to investment in the electricity supply industry  
(OEEC publication, November 1954).
- [2] Electricity rates  
- administrative regulations concerning the supply of electricity  
(OEEC publication, January 1957)
- [3] The theory of marginal cost and electricity rates  
(OEEC publication, March 1958)
- [4] The trend of the selling price of electricity and its relation  
to the financing of new plant  
(OEEC publication, March 1958)
- [5] Amortization and cost calculations  
(UNEPDE publication, Congress of Lausanne, 30 June to 8 July 1958)
- [6] "Capital for electric energy requirements"  
Report submitted to the World Power Conference at Madrid (1960) by  
the International Bank for Reconstruction and Development (IB/3).
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